



Seagate & Storage

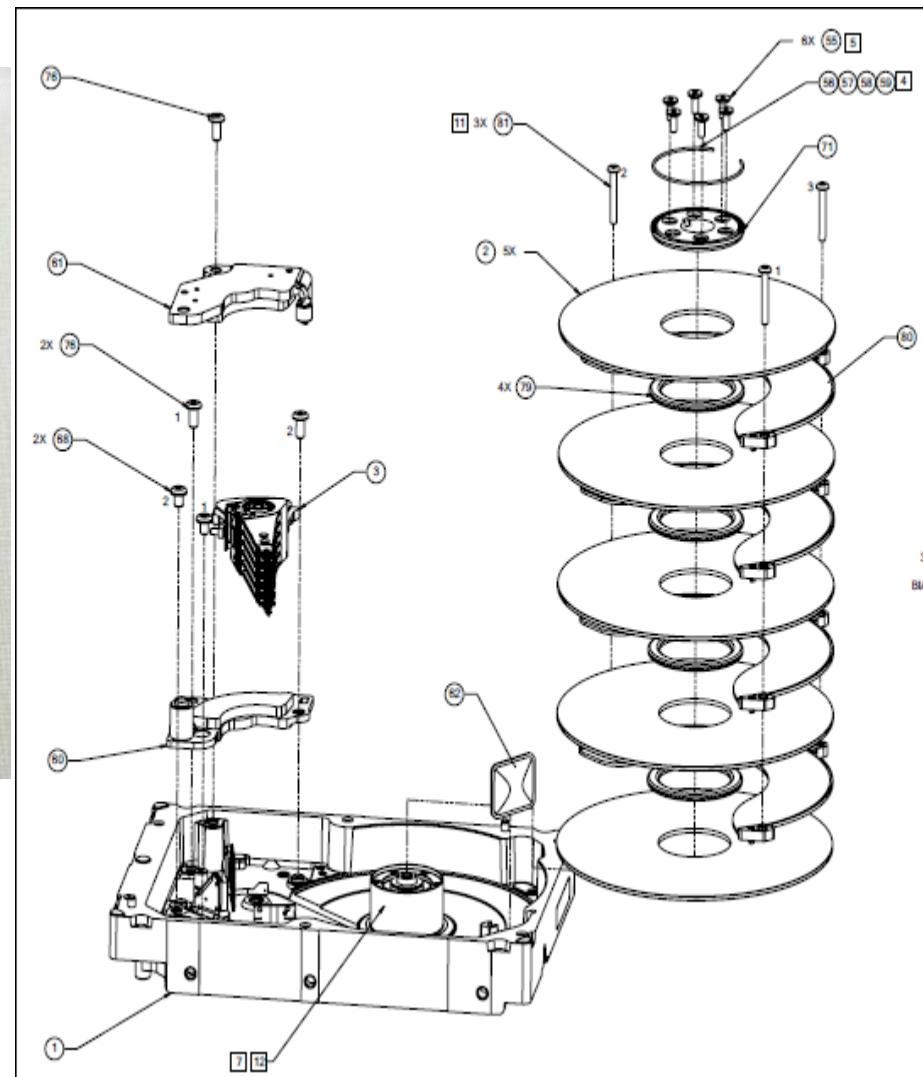
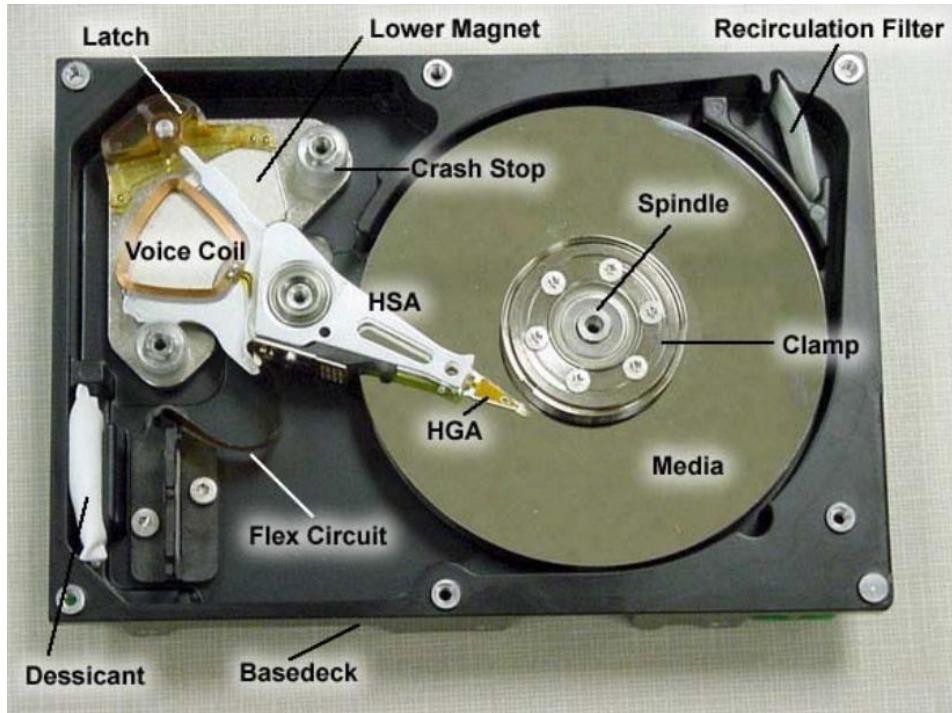




I. Storage technology



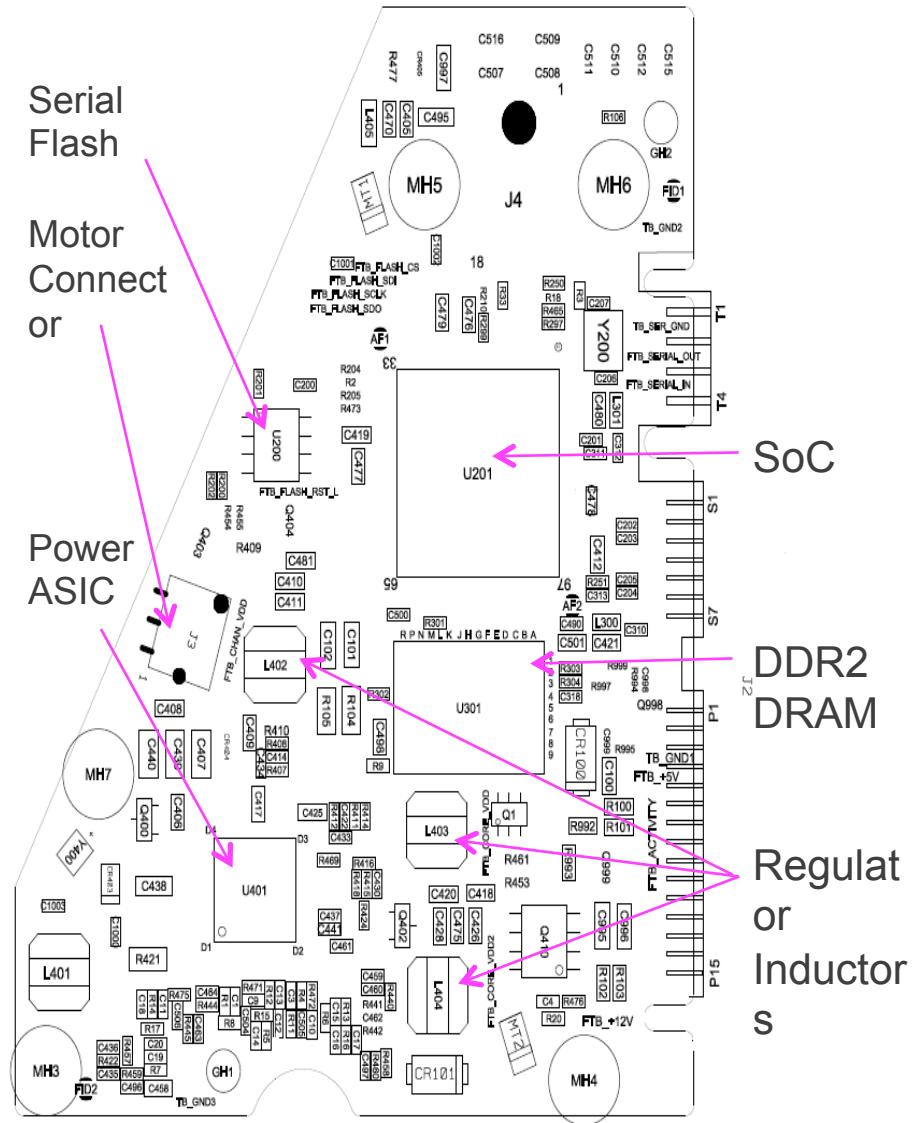
1. HDD basic



HDA Mechanical

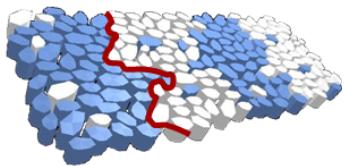


Electrical



2. The challenges to high capacity drives and Seagate's leadership

Thermal Stability



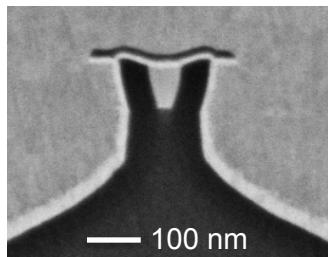
To increase areal density we need to reduce grain size.

However, if grain size is reduced too much, they become unstable

Solutions:
Heat Assisted Magnetic Recording
(HAMR)

Bit Patterned Media
(BPM)

Writer/Reader Scalability



To increase areal density we need to reduce track pitch. We are fast approaching the limits of how narrow we can make writers and readers

Writer Solutions:
Shingled Magnetic Recording
(SMR)

Reader Solutions:
Two-Dimensional Magnetic Recording
(TDMR)

Fixed Form Factor



To increase drive capacity we can add more heads and disk to the media. However, we are constrained by fixed form factors

Solutions:
Helium/Gas Filled Drives

New form factors

Areal Density Growth has been great!

Multiple Technology Transitions

Hard Drive

Rotary Actuator (1975)
Thin Film Head (1978)
MR Head (1993)
GMR Head (1998)
PMR (2006)

Optical

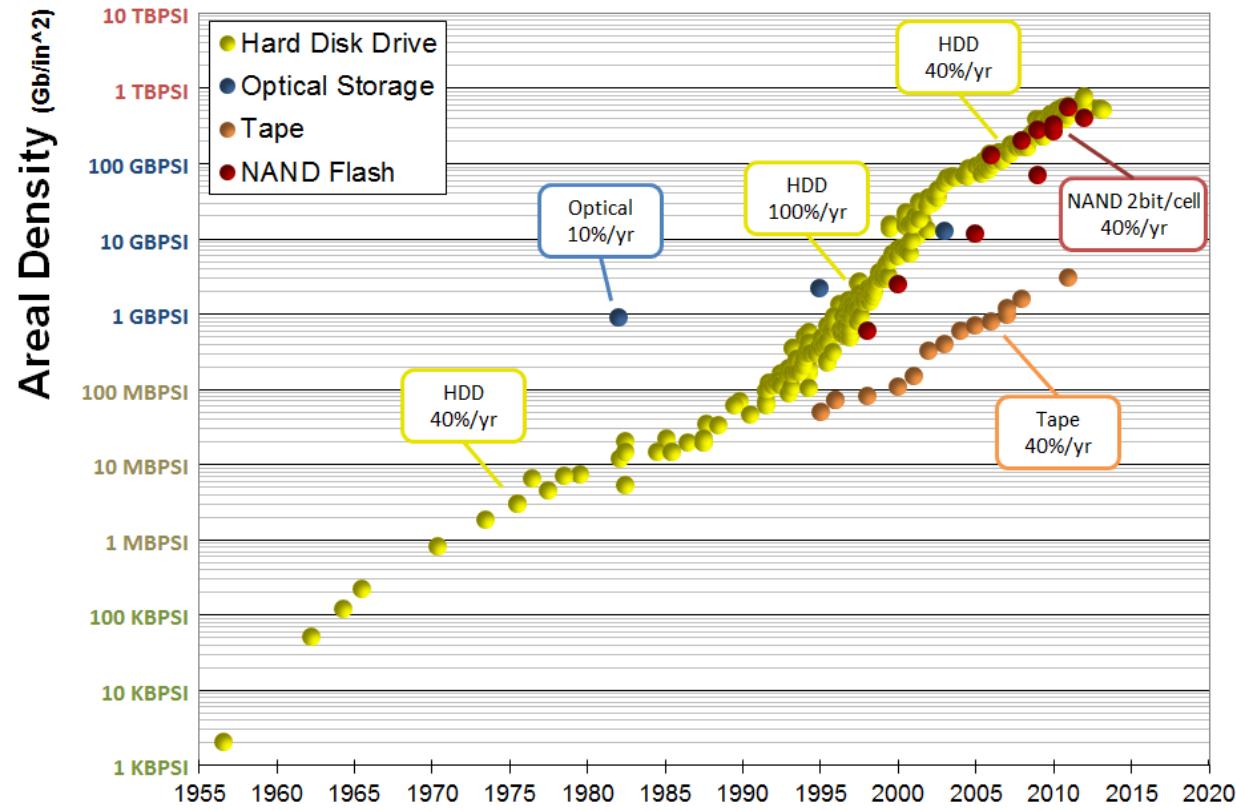
DVD (1995)
Blu Ray (2003)

Tape

Helical Tape (1987)
Servo Track (1995)
PRML Channel (1996)
Optical Servo (2000)
GMR (2008)

Flash

NAND Invented (1987)
MLC NAND (2001)
2-bit per cell (2006)
3-bit/cell demonstrated (2009)



Economics of lower storage cost

- Hughes' Conjecture:
 - If the \$/GB is reduced by half the amount of storage demanded doubles.
- Lemma
 - Double capacity only requires equivalent aggregate performance
 - As the cost of storage approaches \$0, the demand for storage approaches infinity.
- True since 1960...

The future is Bright!

Next Technology Transitions are hard

Hard Drive

10% - 40% Growth Expected

Optical

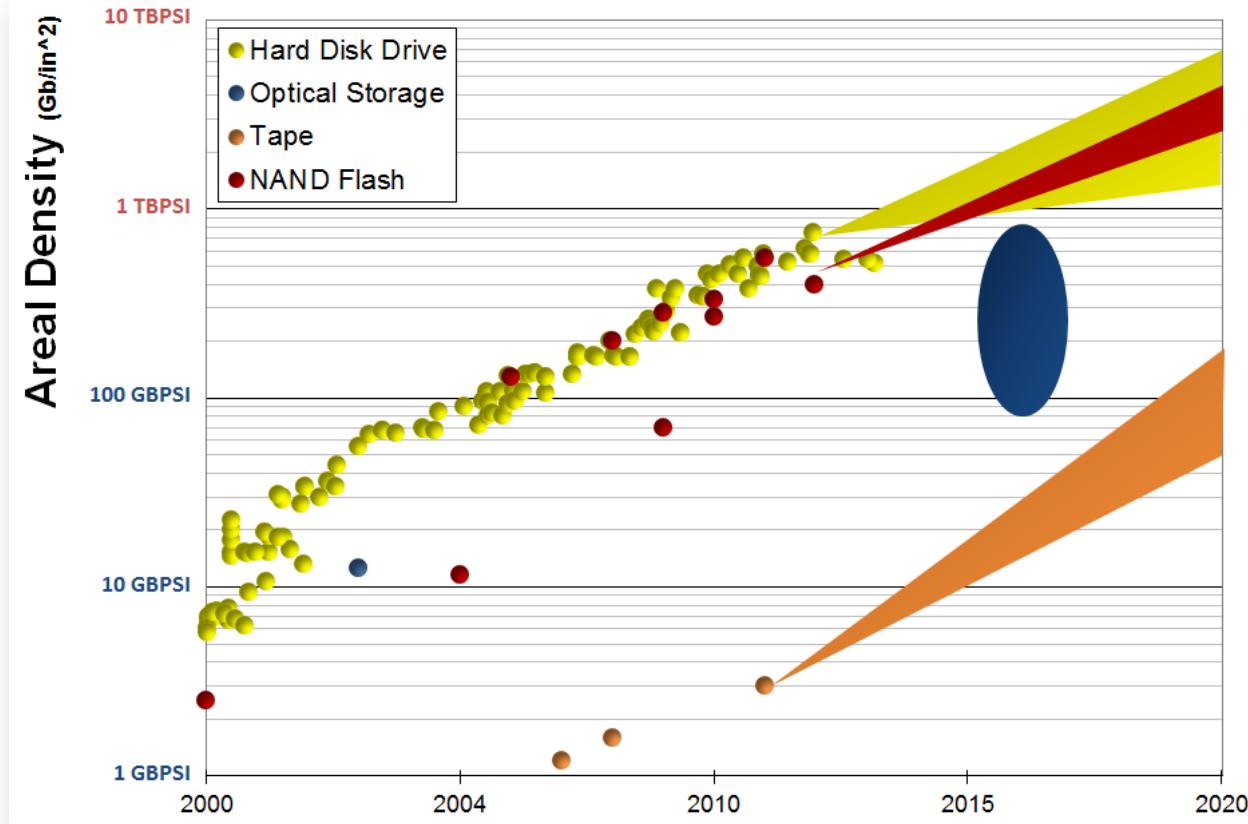
Not clear on 4th Gen Technology

Tape

40% - 80% Growth Expected

Flash

20% - 40% Growth Expected

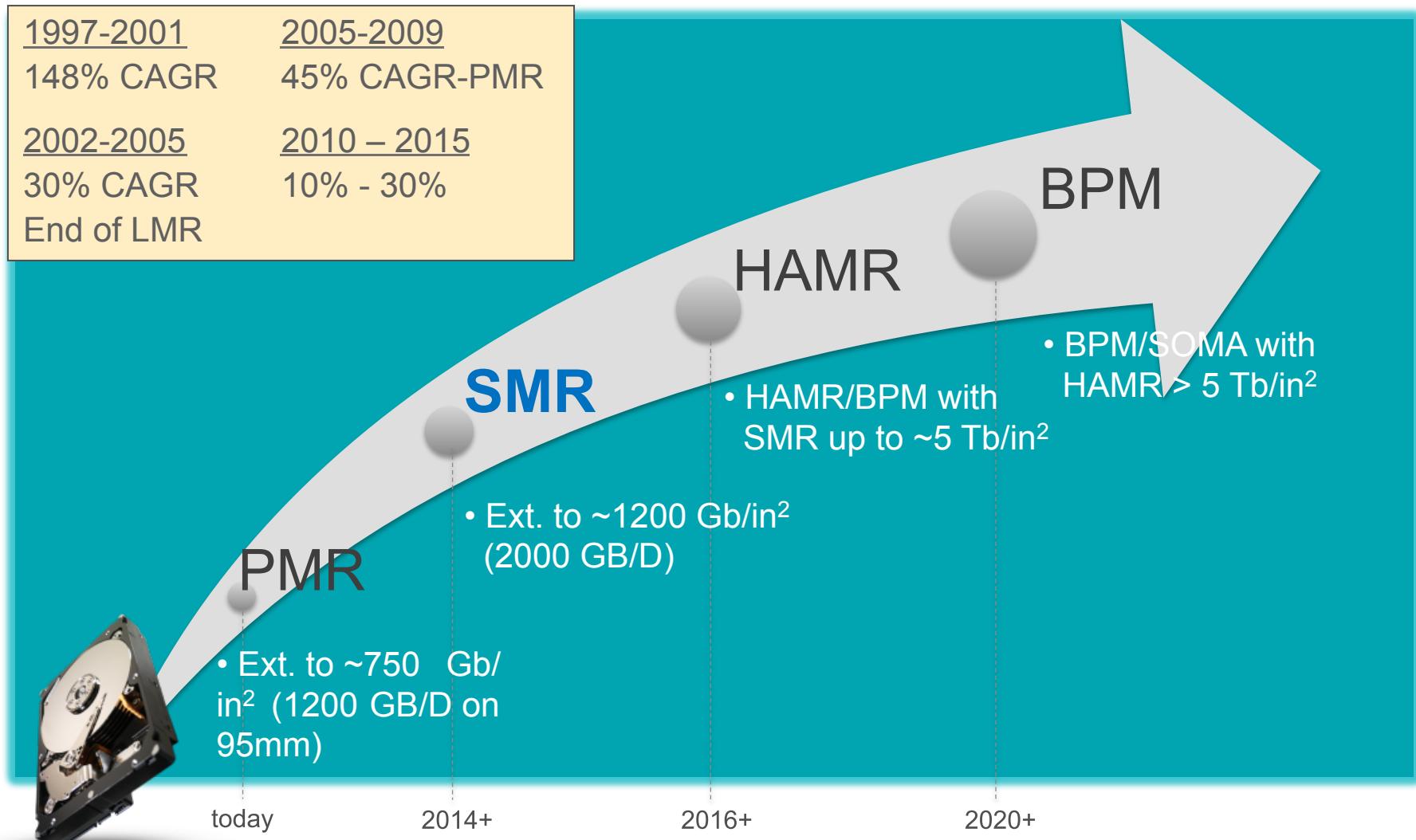


Notes:

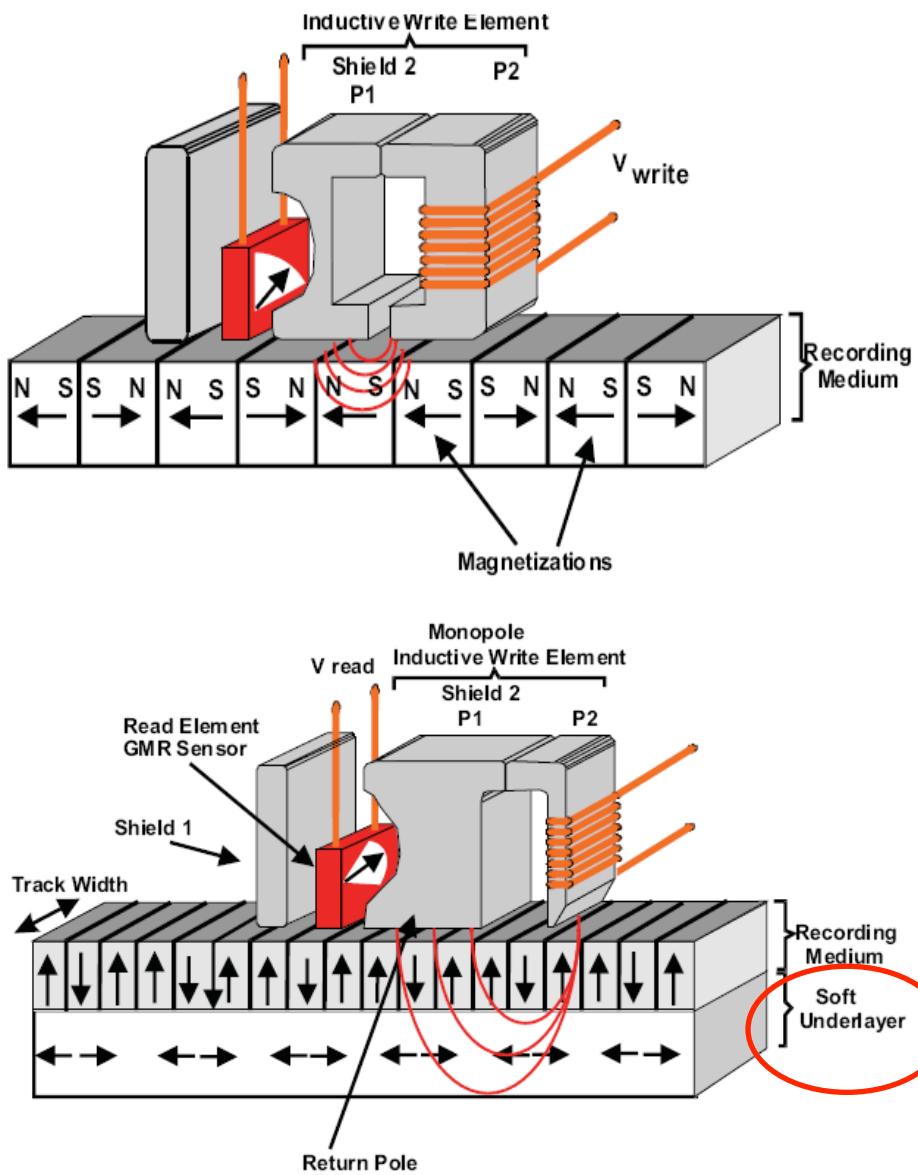
Flash growth is flash in general and may not be representative of compute grade flash

Tape growth relies on them leveraging HDD areal density growth enablers which may not be possible

Leading the Recording Technologies Progression

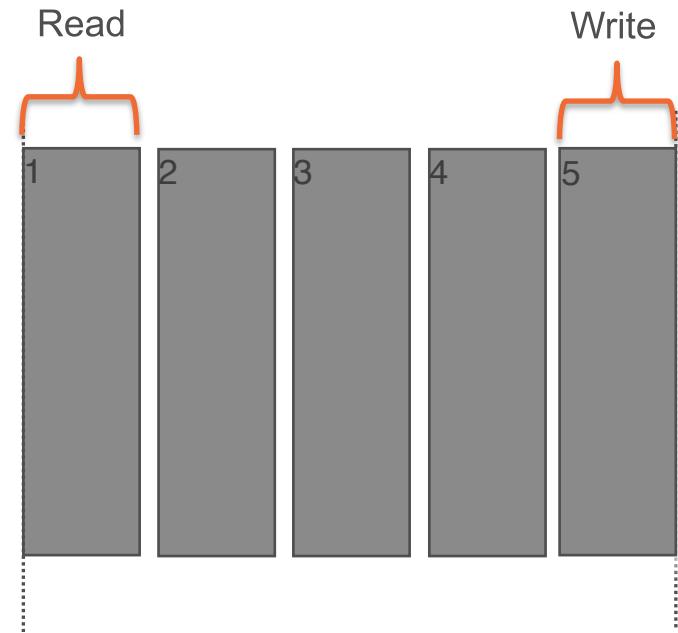


PMR(垂直磁记录)



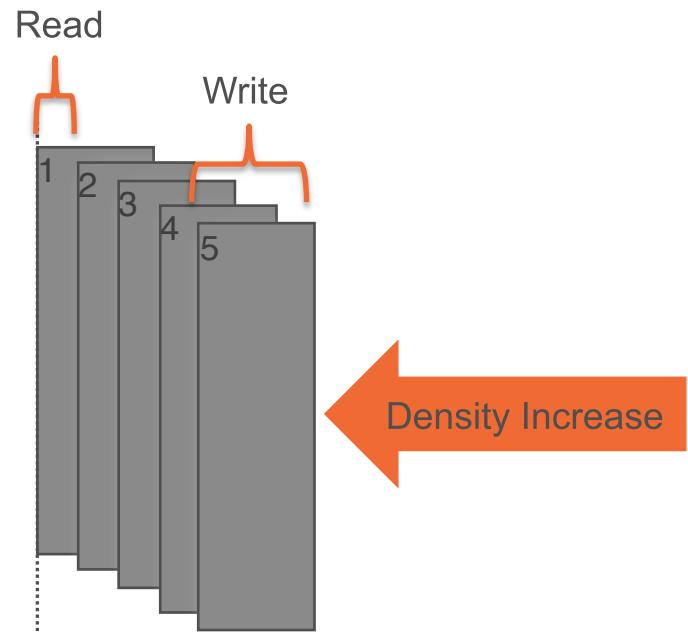
SMR Technology

- SMR aims to more than double the disk's areal density
- Layers tracks like shingles on a roof



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Recording Head development

GMR Head

1997 Writer, Reader separated



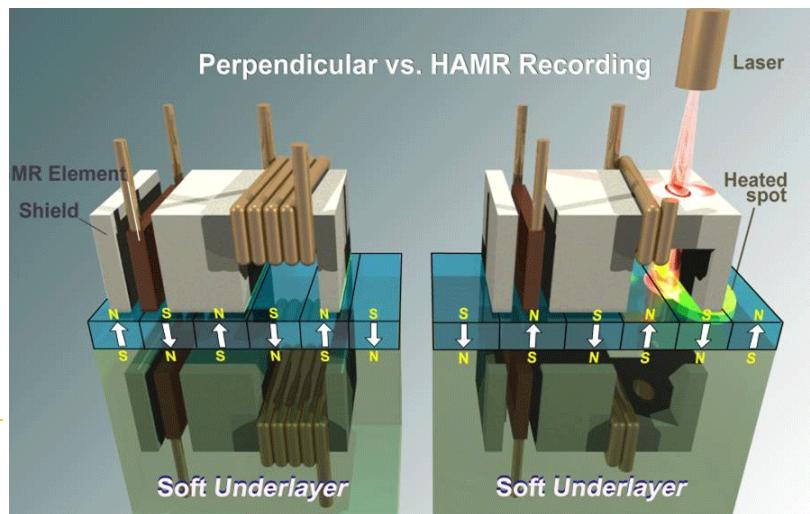
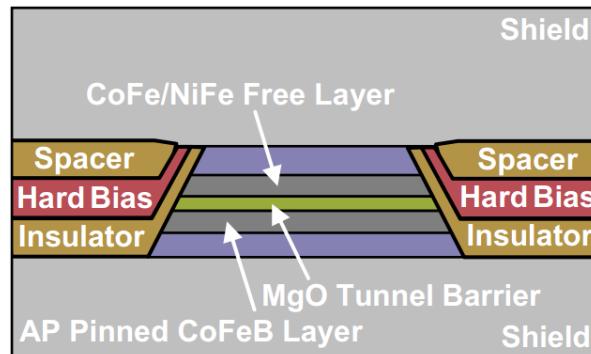
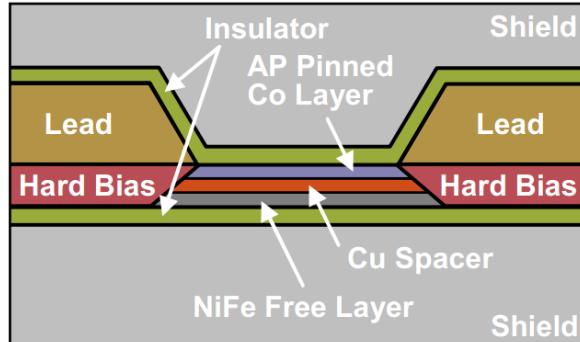
TMR Head

2006- current Writer, Reader separated – 1TB/Disk



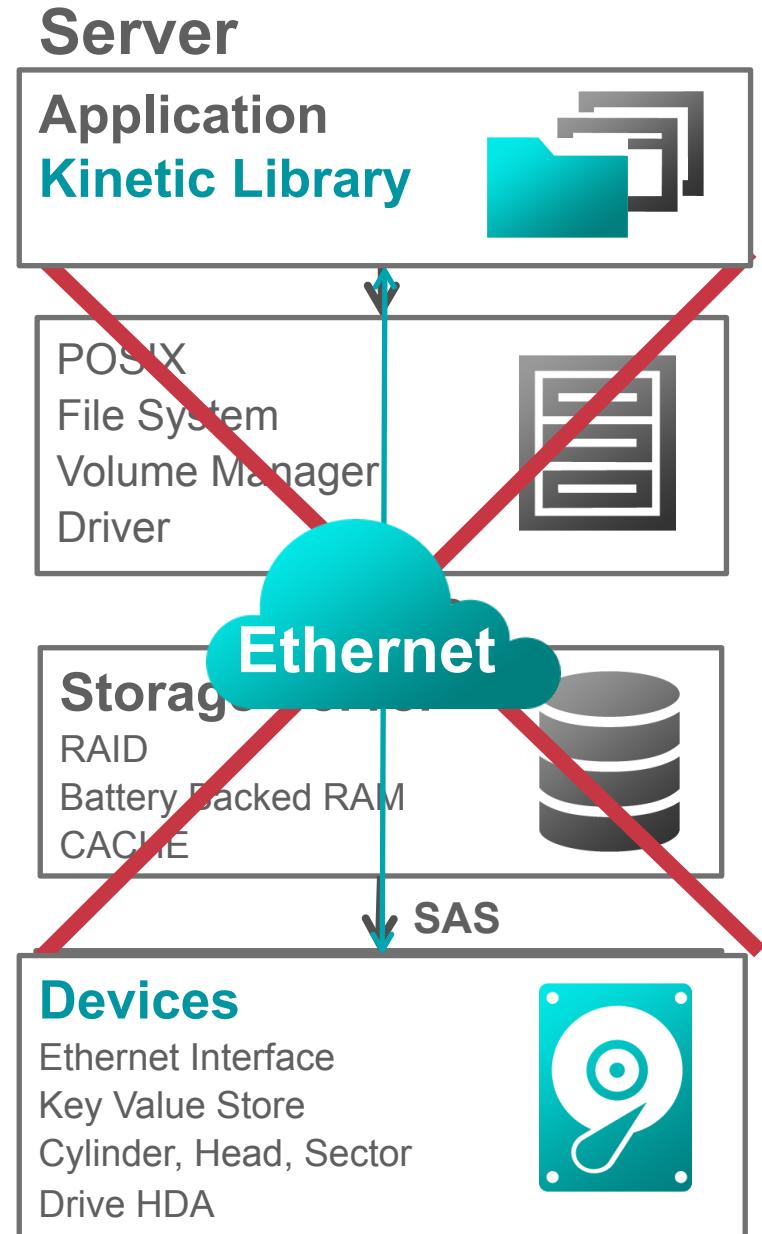
HAMR Head

(heat-assisted magnetic recording)



IP Disk Drive

- Current architectures built on layers of legacy technology
 - Translation of application request to physical drive creates unnecessary overhead
 - Necessitate tiers of storage servers to manage the translation
- Kinetic cuts through these layers
 - Applications communicate directly with drives via Ethernet
- Puts the drive at a higher semantic level of abstraction
 - More efficient than objects in file systems
 - Enables feature agility



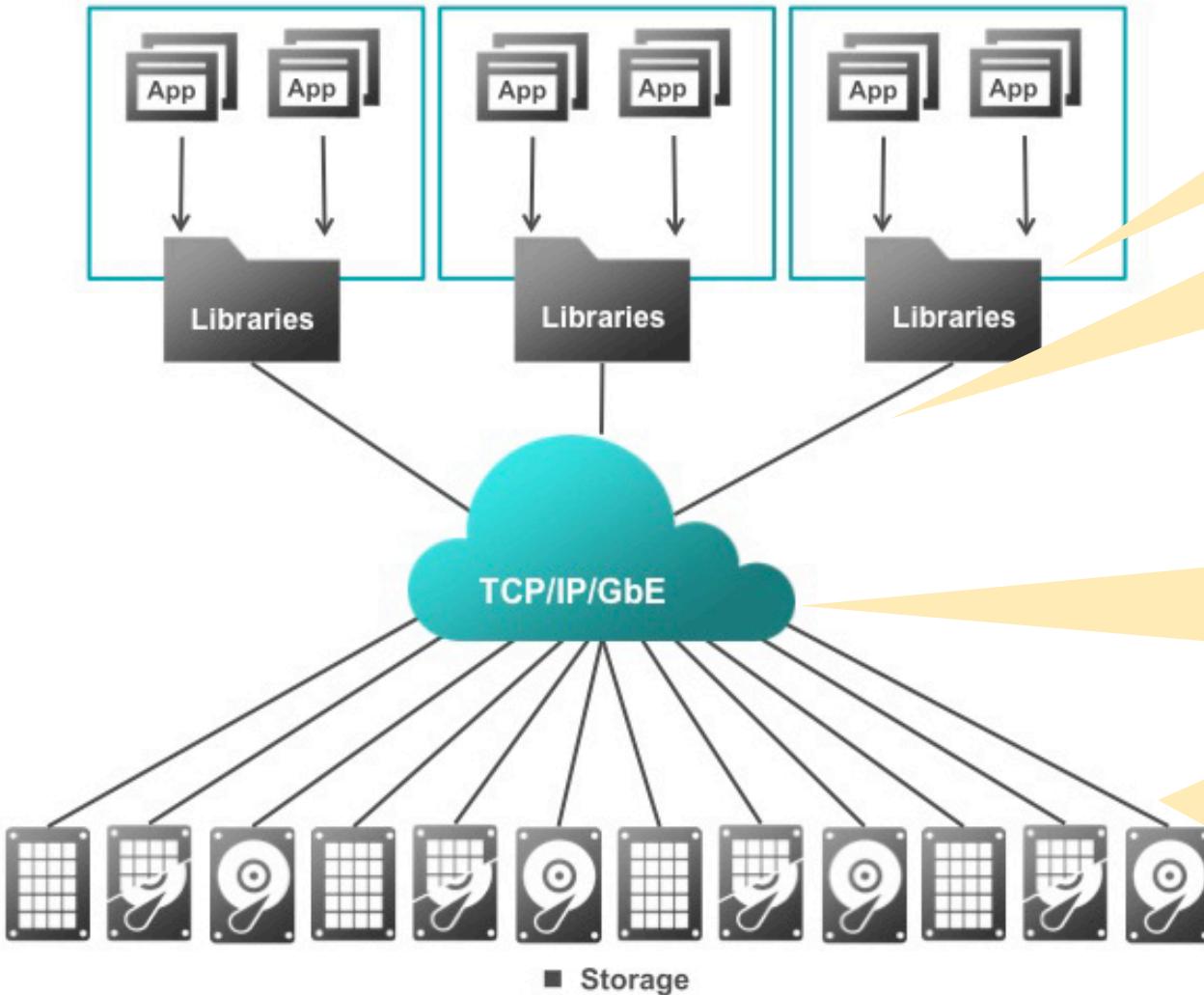
How the Kinetic Open Storage Platform Works

PARTNER CODE

OPEN

STX

■ Applications ■ Clustering ■ Management



Easy Integration: Apps and cloud storage stacks seamlessly build on **Kinetic libraries** openly available

Simplifies the SW stack: Libraries interact with the drive using a **Key Value API** that is in tune with modern storage paradigms

Simplifies the HW stack: **Ethernet** breaks free from SAS/ SATA constraints while reducing capex and opex

Translates across device types: Kinetic supports multiple device types. Initial offering leverages Nearline 3.5-inch platform



II. Seagate Overview



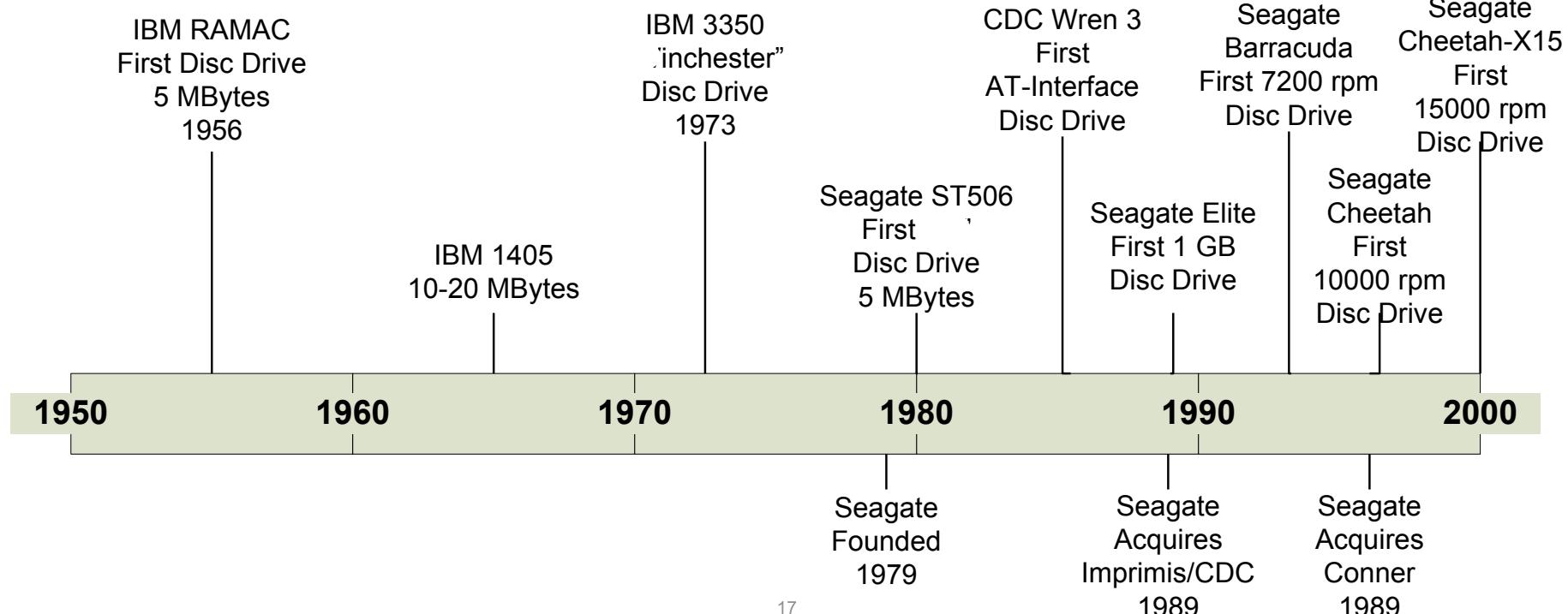
1.HDD History & Seagate

1956, first HDD produced by IBM

- 5 MB, 40pcs 26-inch discs

1979, Seagate founded

- Storage industry leader, generated **first 7200/10000/15000RPM HHD**
- Seagate acquires Maxtor in 2005, acquires Samsung in 2011
- 1st Seagate SSD launched in 2009/12
- Seagate Momentus XT as **1st Hybrid** launched in 2010
- Constellation CS as **1st Cloud HDD** launched in 2012
- Seagate Edison as 1st Enterprise Hybrid announced in 2013



2. Seagate Overview: Storage Leader

- **Seagate is the world's leading provider of storage devices**
 - Q1FY2014*: 55.7 million drives shipped; revenue of \$3.5 billion
- **Provides storage for enterprise, desktop, mobile computing, consumer electronics and retail markets**
 - Builds hard disk, solid state hybrid and solid state drives
 - 40% overall market share
 - Broadest product offering in the industry—largest customer base
- **Owns and vertically integrates critical technologies: heads and media**
- **Approximately 52,395** employees worldwide**

* For first fiscal quarter ended September 27, 2013

** Includes interns and agency temps

3. Seagate Products, Customers and Markets

Internal Storage



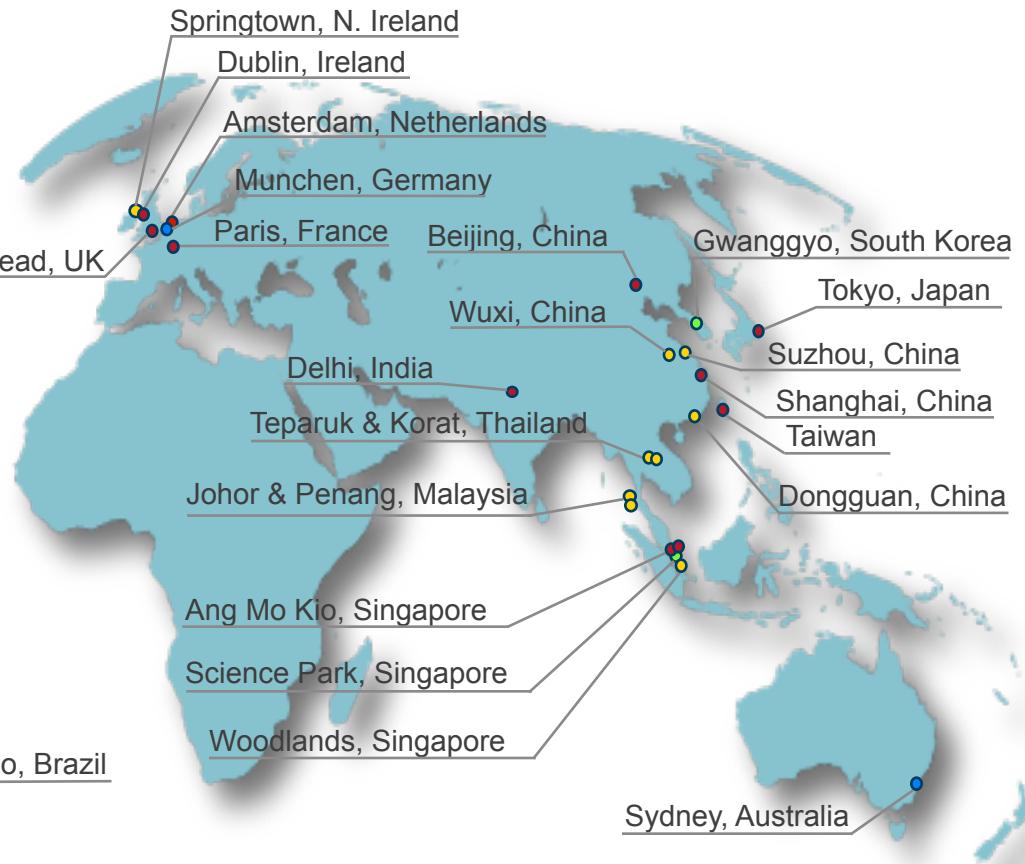
Branded Products



Services and system



4. Seagate Global Presence



- HQs, Admin and/or Sales
- Design

- Customer Support
- Drive & Component Mfg

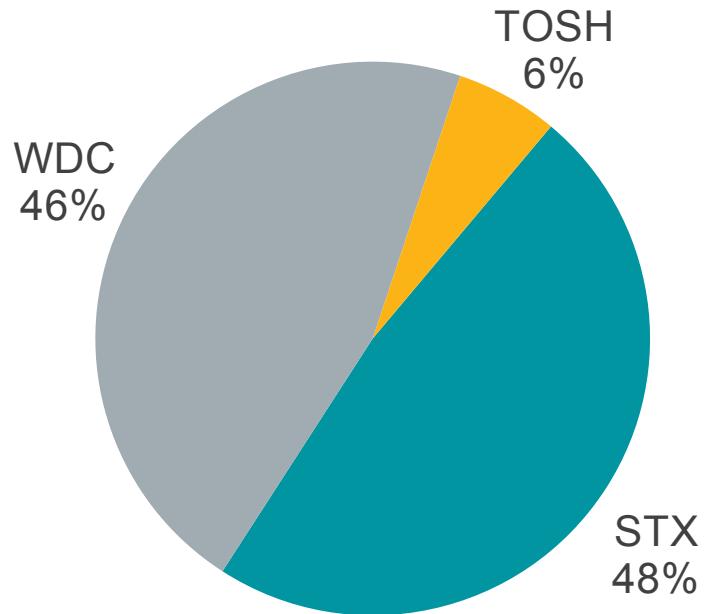
5. Seagate scorecard : Q1 Financial Strength*

Revenue	\$3.5 billion
Net Income	\$427 million
EPS	\$1.16
Shipments	55.7 million
Margin	28%

* GAAP Numbers

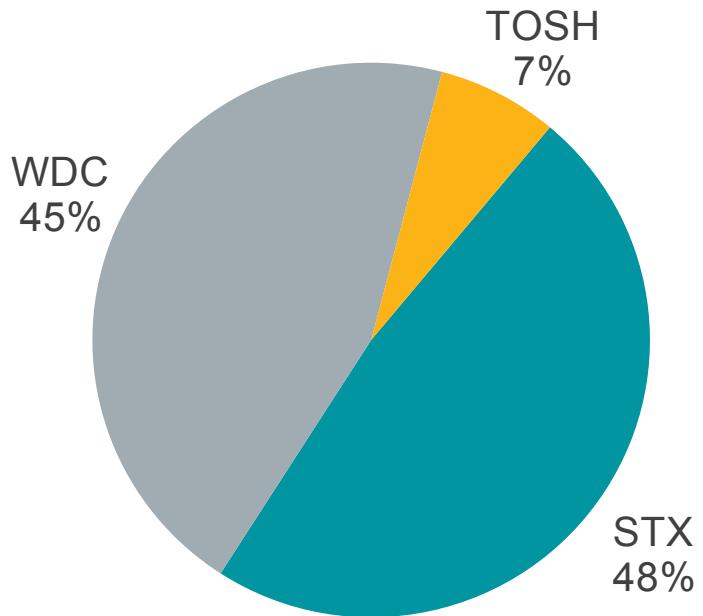
Market Share Estimates

Total Enterprise Market* - Preliminary



Q4 FY13
17.3M Units

Growth
Y/Y = 29%
Q/Q = -2%

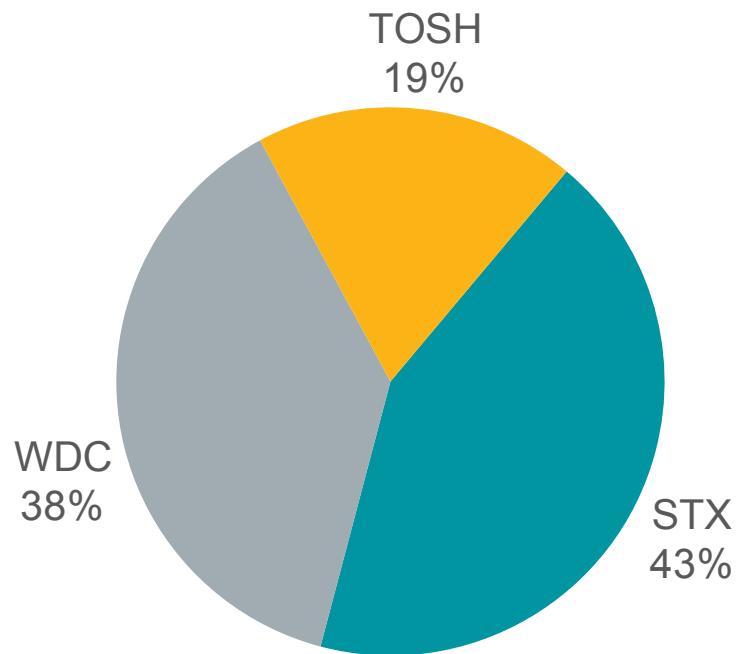


Q1 FY14
16.9M Units

* Includes Mission-Critical (Fibre Channel, SCSI, SAS) drives as well as drives for Nearline applications

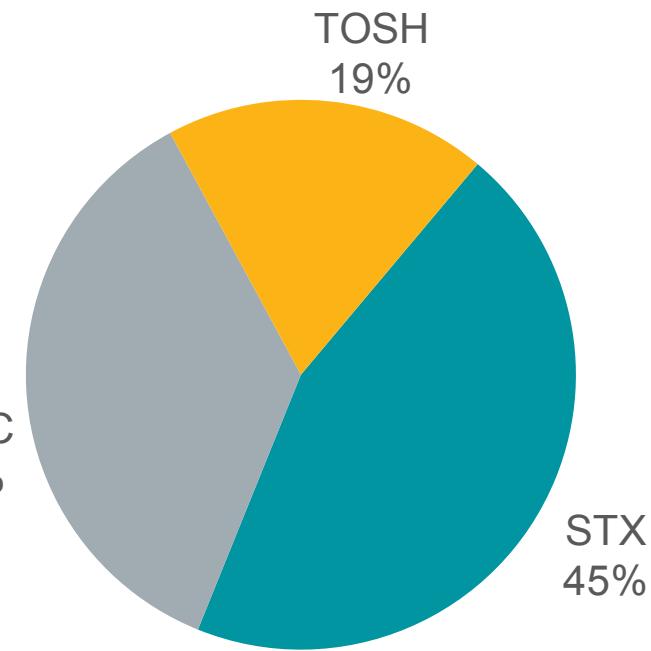
Market Share Estimates

Total Client Non-Compute Market* - Preliminary



Q4 FY13
23.9M Units

Growth
Y/Y = 0%
Q/Q = 6%



Q1 FY14
25M Units

* Includes drives designed specifically for video storage applications and External Storage Solutions

Thank you